

Linkages Between Financial Deepening, Trade Openness, and Economic Development: Causality Evidence from Sub-Saharan Africa

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Summary. — This contribution tests for causality between financial deepening, trade openness, and economic development for 16 sub-Saharan African countries. The Hsiao-Granger method is used to add to the existing empirical evidence. Only limited support is found for the popular hypothesis of finance-led growth. In general, the evidence indicates that financial deepening and trade openness have swayed economic development rather marginally. In particular, the investigated countries have failed to benefit from financial deepening. Development strategies prioritizing financial or trade sector development hence cannot be supported.
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Key words — financial markets, economic growth, openness, Hsiao's Granger causality, Sub-Saharan Africa, South Africa

1. INTRODUCTION

In the last decades, many developing economies have adopted development strategies that prioritize the modernization of their financial systems. The countries of sub-Saharan Africa (henceforth *SSA*) are no exception. Since the end of the 1980s, these countries have been interested in fostering financial development, for example, by reducing governmental intervention in national financial sectors or by privatizing banks. Such policies have been expected to promote growth through, *inter alia*, a higher mobilization of savings or a rise in domestic and foreign investments (e.g., Reinhart & Tokatlidis, 2003). However, the effectiveness of such policies requires a convenient causal relationship between financial and real sectors.

This contribution assesses whether financial deepening has actually swayed economic development in a sample of *SSA* countries and whether a policy focus on financial sector development is appropriate for fostering development. We hence test for causality between finance and economic growth, capturing indirect linkages also by scrutinizing the relationship between finance and trade openness. We add to the existing literature by (1) using econometric methods that are less prone to the misspecifications that occur when testing for causality, (2) employing a composite finance indicator in order to proxy financial depth in a broad sense, (3) distinguishing between short-run and long-run effects between finance, openness, and growth, and (4) taking into account the linkages between finance and openness that allow for further effects on economic development.

This contribution is structured as follows. Section 2 reviews the corresponding academic literature. Section 3 introduces the data and first empirical results. Section 4 presents the findings of the causality analyses. Section 5 concludes with a summary.

2. FINANCE, OPENNESS, GROWTH, AND DEVELOPMENT

(a) *Theory and evidence*

(i) *Finance and growth*

Financial markets provide an economy with certain services such as risk and information management and the pooling and

mobilization of savings. More developed, that is, *deeper*, financial systems are associated with a more effective supply of these services to the real sector. Links between financial and economic development may take different forms. On the one hand, the financial sector may influence growth through the accumulative and the allocative channel. The former emphasizes the finance-induced effects of physical and human capital accumulation on economic growth (e.g., Pagano, 1993); the latter focuses on the finance-induced gains in resource allocation efficiency which translate into augmented growth (e.g., King & Levine, 1993). On the other hand, the development of the financial system may also be initiated by economic growth. For instance, in an expanding economy the private sector may demand new financial instruments and a better access to external finance, so finance activities simply amplify in step with general economic development (e.g., Robinson, 1952). Furthermore, finance and growth may be mutually dependent. The real sector may provide the financial system with the funds necessary to enable financial deepening, eventually allowing for a capitalization on financial economies of scale which in turn facilitates economic development (e.g., Berthelemy & Varoudakis, 1996). That is, the theory provides ground for several causation patterns, where finance leads growth (*supply-leading hypothesis*), finance follows growth (*demand-following hypothesis*), or where the real and financial sector influence each other mutually (*bidirectional causality*). Following more skeptical views as discussed in Chandavarkar (1992), finance and growth may also evolve independently of each other, so no causality exists between them (*insignificant causation*).

Some empirical evidence suggests that certain economies have indeed benefited from well-developed financial systems (e.g., Rousseau & Wachtel, 1998). Still, the causality evidence is not conclusive. For some successful emerging economies finance appears to have been a leading factor of economic success, for example, in Korea (Choe & Moosa, 1999) and Taiwan (Chang & Caudill, 2005). However, no such strong

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connection is identifiable in mature OECD countries (e.g., Shan, Morris, & Sun, 2001). For developing economies, some studies find a leading impact of finance on growth (e.g., Christopoulos & Tsionas, 2004), while others find the finance-growth relationship to be more complex (e.g., Demetriades & Hussein, 1996; Luintel & Khan, 1999). In general, the empirical findings strongly indicate that there is a country-specific dimension to finance-growth dynamics that accounts for frequently ambiguous results across countries.¹

(ii) *Finance and trade openness*

Possible linkages between finance and trade openness open up further channels through which financial and real sectors may interact. On the one hand, mature financial markets may constitute a comparative advantage for industrial sectors that rely heavily on external financing (e.g., Beck, 2003). Thus, economies with developed financial systems are expected to feature industrial and trade structures that are linked to finance-dependent sectors of the economy. On the other hand, increased trade openness may trigger demand for new financial products. Trade carries risks linked to external shocks and foreign competition. Therefore, an increase in trade openness may lead to a supply of more sophisticated financial instruments; in such an environment, financial institutions are expected to evolve so as to provide more adequate insurance and risk diversification (Svaleryd & Vlachos, 2002). Furthermore, domestic interest groups may have a natural interest in obstructing financial development to prevent competitors from entering the market; as international competition increases, such groups may shift their interests toward positive financial sector development, creating another link between the trade and financial sector (Rajan & Zingales, 2003).

The empirical findings confirm the existence of a finance-openness nexus, although the subject has not been studied exhaustively. For instance, Beck (2003) shows that countries with more developed financial systems exhibit higher trade shares in industries that depend on external finance, concluding that finance is an important determinant of trade structures. Similarly, Svaleryd and Vlachos (2005) find that financial sectors significantly determine industrial specialization across OECD countries. Considering the effects of trade on finance, Baltagi, Demetriades, and Law (2009) also find that trade openness is an important determinant of banking sector development.

(iii) *Finance-openness links and development*

Links between finance and openness allow for more complex paths to economic development. On the one hand, if increasing trade openness leads to an increase in financial development, this may promote economic growth where finance is found to enhance growth *via* the allocative and accumulative channels. On the other hand, if finance induces openness, it may subsequently foster growth where openness is found to be a growth factor. Openness may induce economic growth in several ways, for example, by increasing a country's level of specialization or by positively affecting innovation and technological diffusion. Empirical evidence suggests that trade openness may indeed positively affect economic performance (e.g., Edwards, 1998; Harrison, 1996).²

(b) *Finance and development in sub-Saharan Africa*

(i) *Economic development*

During the last decades, the economic performance of *SSA* has been distinctly worse than that of other developing parts

of the world. During 1960–80, average annual *per capita* income growth in the region was 1.3%, compared to 2.5% worldwide. During 1980–2000, *SSA* countries even experienced a decline in annual growth rates of about –0.6% on average, where the world grew at an annual rate of 2.7%.

Sachs and Warner (1997) attribute the region's poor economic performance to geographical factors and inappropriate economic policies. In particular, they argue that the lack of international integration is an obstacle to better performance. Collier and Gunning (1999) similarly suggest that geographical disadvantages negatively affect economic growth in *SSA*. They argue that poor economic policies also impair growth, for example, manifesting in a lack of trade openness, poor infrastructure, or the underdevelopment of financial and product markets.

(ii) *Financial development*

Financial systems in *SSA* can be described as underdeveloped. Financial sectors in *SSA* suffer from various unfavorable characteristics such as limited financial products and financial innovation, wide interest rate spreads, weak legal systems, and pronounced market fragmentation (Ncube, 2007). The level of financial depth and efficiency in *SSA* is rather low, also in comparison to other developing world regions. Financial systems in *SSA* are strongly bank based, whereas stock markets are generally not well developed. Nevertheless, over the past four decades *SSA* has seen some financial deepening. For instance, the ratio of private credit to GDP in Burundi increased from 2.5% in 1960 to 23% in 2003. Similarly, the private credit to GDP ratio in South Africa rose from 46.5% in 1966 to 79.2% in 2004. General overviews on financial development in *SSA* can be found in Reinhart and Tokatlidis (2003) and Ncube (2007).

From the above discussion, one would expect a distortionary rather than promoting effect of finance on economic development. Empirical studies on this issue for *SSA* yield mixed results. Some studies suggest that financial factors have enhanced economic growth in the past, for example, by positively influencing investment (e.g., Ndikumana, 2000). Others indicate that the impact of financial development on growth has been rather negligible (e.g., Anoruo & Ahmad, 2001; Adjasi & Biekpe, 2006). The issue of finance-growth causality is far from settled. While Ghirmay (2004) finds strong evidence of a virtuous circle of finance and growth, the results of Atindehou, Gueyie, and Amenounve (2005) indicate the opposite, with finance and growth exhibiting only a weak causal relationship. The ambiguity of the empirical literature, especially with respect to finance-growth causality, is an additional motivation for our analysis.

3. DATA AND FIRST EMPIRICAL RESULTS

(a) *General methodology*

In the following, we test for causality between finance, openness and growth. As previously discussed, causal links may take different forms. (1) In order to reveal the exact nature of the causality interrelations, we create a composite indicator of financial deepening *via* a principal component analysis in order to capture financial system developments in a broader sense, while avoiding the problems associated with multicollinearity and over-parameterization. By using this approach, we also avoid the imbalanced representation of certain aspects of financial deepening by using only certain narrow finance indicators. To validate our findings, we also use a more common

measure of financial deepening. (2) We employ unit root and cointegration tests to identify the stationary properties and possible cointegration relationships of the investigated time series. Building on these tests, we avoid spurious empirical findings in the later causality analyses. (3) We test for Granger causality in a modified framework following Hsiao (1979,1982), using bivariate and trivariate vector autoregressive (*VAR*) or vector error correction models (*VECMs*). Misspecifications within such models may lead to spurious and inconsistent results, as shown by Braun and Mittnik (1993). In particular, standard Granger causality analyses may suffer from problems of arbitrary lag length selection as the variables are constrained to all enter at the same lag length; our procedure avoids such problems as all variables can enter at different lag lengths. We are also able to differentiate between short-run and long-run causality as we take any error correction (*ECM*) term estimate as evidence of a long-run causal relationship between the considered variables; however, such an interpretation is only feasible if the ECM estimate is negative and statistically significant (Wickens, 1996).

(b) Data

We use annual time-series observations as they are sufficient to ensure the quality of the analysis, as argued by Hakio and Rush (1991). Data for the individual finance indicators is taken from the *Financial Development and Structure Database* of Beck, Demirgüç-Kunt, and Levine (2001). Specifically, we extract the finance proxies *commercial bank assets to commercial bank plus central bank assets (DBMAs)*, *liquid liabilities to GDP (LL)*, and *private credit by deposit money banks to GDP (PC)*.³

Data for economic growth and trade openness are taken from the *PENN World Table*, version 6.2, compiled by Heston, Summers, and Aten (2006). As for economic growth, we use the logarithm of real GDP *per capita* (log-level data), labeled *GROWTH (G)*. For trade openness we use the logarithm of the sum of exports plus imports to real GDP (log-level data), labeled *TRADE (T)*. As Harrison (1996) suggests, this measure is a simple and common indicator of trade openness.⁴

As shown in Table 1, we use observation periods for finance, openness, and growth data from the 1960s (matching the years the countries achieved independence) to 2003/2004.

(c) Principal component analysis

In the related literature several proxies for financial deepening have been suggested, for example, monetary aggregates such as *M2 to GDP*. To date there is no consensus on the superiority of any indicator. Following the recent example by Ang and McKibbin (2007), we construct a composite indicator of financial deepening to obtain an indicator that is as broad as possible. Specifically, we use the finance proxies *DBMA*, *LL*, and *PC* to construct this index, labeled *DEPTH (D)*, via a principal component analysis. As stated above, *SSA* financial systems are strongly bank based, so we use finance indicators that are primarily associated with bank development.

The principal component analysis is employed to reduce data sets to lower dimensions while retaining as much information of the original sets as possible. In our case, having transformed the finance indicators into natural logarithms, only the first unrotated principal component is extracted as *DEPTH*. Table 1 gives an overview of the results of the principal component analysis as well as a descriptive overview of the investigated countries. Our index *DEPTH* is usually the only component to show fitting characteristics. It generally exhibits either at least 60% of the initial variance of the considered series or an eigenvalue that is significantly larger than one. Thus, the index provides sufficient information on financial deepening.

(d) Unit root test

As a next step, we use the unit root test by Phillips and Perron (1988), the *PP test*, to check whether the considered time series is stationary, that is, *I(0)*, or first difference-stationary, that is, *I(1)*; the existence of unit roots may contaminate our causality findings because of the properties of nonstationary time series. We use the *PP test* as it is

Table 1. Summary statistics and results of principal component analysis

Country (data availability)	DEPTH (principal component), %	Component matrix		
		DBMA	LL	PC
Burundi (1966–2003)	75.53	0.738	0.863	0.973
Cameroon (1969–2003)	83.82	0.838	0.916	0.986
Cote d'Ivoire (1971–2003)	68.89	0.681	0.882	0.909
Ethiopia (1967–2003)	58.00	0.951	−0.715	0.570
Gabon (1964–2004)	57.96	0.457	0.764	0.973
Ghana (1964–2003)	74.05	0.817	0.888	0.909
Kenya (1967–2003)	72.46	−0.770	0.974	0.795
Madagascar (1965–2004)	50.66	0.864	0.866	0.158
Mauritius (1967–2004)	79.69	0.756	0.964	0.943
Nigeria (1961–2004)	72.36	−0.636	0.937	0.943
Rwanda (1966–2003)	84.71	0.828	0.959	0.968
Senegal (1972–2003)	51.78	0.322	0.781	0.916
Sierra Leone (1970–2003)	64.59	0.810	0.676	0.907
South Africa (1966–2004)	65.78	0.896	−0.674	0.846
The Gambia (1965–2003)	43.27	0.462	−0.832	0.626
Togo (1974–2004)	65.13	−0.507	0.956	0.885

Notes: The column *DEPTH* contains the value of the initial eigenvalues as a percentage of the total variance the first principal component contains (percentage of variance criterion) that represents the composite indicator of financial deepening. Following the standard income measurement of the World Bank as taken from Beck *et al.* (2001), South Africa, Mauritius, and Gabon can be classified as Upper Middle Income countries, and Cameroon as a Lower Middle Income country, while all the others are Low Income countries.

particularly powerful when low frequency data are used (Choi & Chung, 1995). As reported in Table 2, in almost all cases the PP test fails to reject the null hypothesis of the existence of a unit root for the data at log-levels, whereas in all but two cases the null hypothesis is rejected strongly when the first difference is taken. The examined time series are thus $I(1)$ at log-levels and $I(0)$ at log-differences, so we apply a difference filter to the data at log-levels in order to obtain stationarity.

(e) *Cointegration analysis*

We test for cointegration in bivariate and trivariate VAR models using log-level data, following Johansen (1988). Two tests are available: the trace statistic and the maximum eigenvalue test. We only report the trace statistic so as to obtain more robust results (Cheung & Lai, 1993). Table 3 shows the cointegration results for the trivariate VAR models.⁵ For Ghana, Nigeria, Rwanda, Senegal, and Sierra Leone, at

Table 2. *Phillips–Perron unit root test statistic*

County		Level		First difference	
		$Z(t_a)$	$Z(t_{at})$	$Z(t_a)$	$Z(t_{at})$
Burundi	G	-2.310	-1.946	-6.760***	-7.236***
	T	1.090	-0.433	-5.047***	-5.814***
	D	-0.839	-2.443	-5.452***	-5.372***
Cameroon	G	-1.599	-1.584	-2.798*	-2.767
	T	-0.856	-1.544	-3.763***	-3.701**
	D	-0.999	-1.654	-2.661*	-2.642
Cote d'Ivoire	G	-2.429	-2.298	-5.779***	-5.794***
	T	-1.488	-1.931	-4.635***	-4.562***
	D	-0.937	-2.121	-4.555***	-4.583***
Ethiopia	G	-0.912	-1.804	-8.409***	-8.470***
	T	-1.426	-1.581	-6.894***	-6.892***
	D	-1.490	-1.213	-4.757***	-4.848***
Gabon	G	-1.424	-2.276	-5.751***	-5.990***
	T	-1.824	-2.024	-5.504***	-5.584***
	D	-1.917	-2.199	-6.410***	-7.589***
Ghana	G	-2.283	-3.035	-11.012***	-11.733***
	T	-2.034	-1.531	-9.209***	-13.057***
	D	-0.920	-0.169	-7.644***	-8.394***
Kenya	G	-3.062**	-3.548**	-7.293***	-7.164***
	T	-1.456	-1.372	-6.423***	-6.436***
	D	-2.445	-1.513	-6.805***	-7.687***
Madagascar	G	0.064	-3.404*	-6.816***	-6.866***
	T	-1.021	-2.039	-7.313***	-10.764***
	D	-1.392	-1.064	-4.197***	-4.240***
Mauritius	G	0.337	-3.470*	-5.959***	-5.764***
	T	-2.094	-2.018	-5.632***	-5.534***
	D	-0.748	-1.621	-6.039***	-5.983***
Nigeria	G	-1.931	-2.004	-4.791***	-4.735***
	T	-1.015	-2.606	-9.226***	-9.146***
	D	-1.804	-2.182	-5.900***	-5.826***
Rwanda	G	-2.471	-2.434	-7.264***	-7.154***
	T	-1.705	-2.059	-9.235***	-10.186***
	D	-1.806	-1.599	-4.383***	-4.472***
Senegal	G	-3.676***	-3.653**	-6.502***	-6.417***
	T	-2.269	-2.628	-8.021***	-8.603***
	D	-2.391	-3.046	-3.721***	-3.454*
Sierra Leone	G	0.123	-1.684	-4.132***	-4.051**
	T	-3.943***	-4.520***	-24.687***	-24.984***
	D	1.256	1.805	-5.875***	-5.805***
South Africa	G	-0.608	-1.591	-4.232***	-4.165***
	T	-1.332	-0.867	-5.054***	-5.337***
	D	-0.451	-3.003	-5.654***	-5.708***
The Gambia	G	-2.444	-2.530	-5.151***	-5.041***
	T	-2.183	-2.162	-5.511***	-5.465***
	D	-0.584	-2.803	-6.373***	-6.283***
Togo	G	-1.179	-1.811	-5.100***	-5.237***
	T	-1.916	-1.827	-3.451**	-3.478*
	D	-2.845*	-4.440***	-4.922***	-5.068***

Notes: $Z(t_a)$ and $Z(t_{at})$ denote the PP test statistics with a constant, and a constant with a linear trend, respectively. (***), (**), and (*) denote significance at 1%, 5%, and 10% levels, respectively. The critical values were taken from MacKinnon (1996). G, T, D indicate the series for growth, trade openness, and financial depth, respectively.

Table 3. *Johansen trace statistics for trivariate VAR*

Country	Hypothesized trace No. of CE (H_0)	0.05 Critical value	0.10 Critical value	Statistic
Burundi	None	16.959	29.797	27.067
	At most 1	7.990	15.495	13.429
	At most 2	0.880	3.842	2.706
Cameroon	None	24.020	29.797	27.067
	At most 1	10.638	15.495	13.429
	At most 2	1.298	3.842	2.706
Cote d'Ivoire	None	21.417	29.797	27.067
	At most 1	5.142	15.495	13.429
	At most 2	0.554	3.842	2.706
Ethiopia	None	24.695	29.797	27.067
	At most 1	8.420	15.495	13.429
	At most 2	1.381	3.842	2.706
Gabon	None	16.031	29.797	27.067
	At most 1	5.763	15.495	13.429
	At most 2	0.957	3.842	2.706
Ghana	None	53.468	29.797**	27.067*
	At most 1	12.271	15.495	13.429
	At most 2	0.210	3.842	2.706
Kenya	None	24.254	29.797	27.067
	At most 1	10.748	15.495	13.429
	At most 2	3.882	3.842**	2.706*
Madagascar	None	22.537	29.797	27.067
	At most 1	5.122	15.495	13.429
	At most 2	0.012	3.842	2.706
Mauritius	None	13.327	29.797	27.067
	At most 1	4.635	15.495	13.429
	At most 2	0.182	3.842	2.706
Nigeria	None	27.250	29.797	27.067*
	At most 1	7.742	15.495	13.429
	At most 2	0.335	3.842	2.706
Rwanda	None	36.636	29.797**	27.067*
	At most 1	16.450	15.495**	13.429*
	At most 2	3.997	3.842**	2.706*
Senegal	None	31.298	29.797**	27.067*
	At most 1	12.824	15.495	13.429
	At most 2	2.217	3.842	2.706
Sierra Leone	None	34.064	29.797**	27.067*
	At most 1	11.845	15.495	13.429
	At most 2	1.139	3.842	2.706
South Africa	None	25.375	29.797	27.067
	At most 1	10.056	15.495	13.429
	At most 2	1.260	3.842	2.706
The Gambia	None	18.275	29.797	27.067
	At most 1	6.610	15.495	13.429
	At most 2	0.935	3.842	2.706
Togo	None	24.949	29.797	27.067
	At most 1	9.768	15.495	13.429
	At most 2	1.157	3.842	2.706

Notes: (**) and (*) denote rejection of the H_0 hypothesis that is related to the number of cointegration equations (CEs) at 5% or 10% significance levels. The critical values were taken from MacKinnon, Haug, and Michelis (1999). The test was conducted under the assumption of a linear deterministic trend. The lag orders of the underlying VAR were chosen via the BIC, where the maximum lag length was 4, with the exception of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lags) due to considerably different time horizons.

most one cointegration relationship between the series is found at the 5% or 10% significance level. When a cointegration relationship is present, finance, growth, and trade openness share a common trend and long-run equilibrium as suggested theoretically. Due to such a cointegration relationship, we include an ECM; hence any VAR passes into a VECM (Engle & Granger, 1987). With respect to the other countries in our sample we find no evidence of cointegration between the three series, so we test for causality in a standard VAR framework using log-difference data.

4. CAUSALITY ANALYSIS

(a) *Hsiao-Granger causality test*

Granger's (1969) definition of non-causality states that if one is able to better predict a series x_t when including information from a series y_t instead of only employing lagged values of x_t , then y_t Granger-causes x_t , denoted $y_t \Rightarrow x_t$. Bidirectional causality, or feedback, is present when x_t also Granger-causes y_t . By combining this causality definition with Akaike's (1969)

Final Prediction Error (*FPE*), we can test for causality in the Hsiao-Granger sense.

In its basic form, the testing procedure requires us to consider an autoregressive process:

$$y_t = \alpha + \sum_{i=1}^m \beta_i(L)y_t + u_t, \quad (1)$$

where the sigma sign in front of L indicates the lag order of the series, L is the lag operator, for example, $Ly_t = y_{t-1}$, u_t is a white noise term with the usual statistical properties, α is a constant term, and β is the coefficient of the exogenous variables. We choose the lag order that yields the smallest FPE, denoted $FPE_y(m, 0)$, where the individual FPE is calculated per the following equation with lags varying from 1 to m :

$$FPE_y(m, 0) = \frac{(T + m + 1)}{(T - m - 1)} \times \frac{SSE}{T}, \quad (2)$$

where T is the number of observations and SSE is the residual sum of squares.

Now, we allow another variable x_t to enter the model, so we receive the subsequent VAR with the established notation:

$$y_t = \alpha + \sum_{i=1}^m \beta_i(L)y_t + \sum_{j=1}^n \gamma_j(L)x_t + u_t, \quad (3)$$

$$x_t = \alpha + \sum_{j=1}^n \gamma_j(L)x_t + \sum_{i=1}^m \beta_i(L)y_t + v_t. \quad (4)$$

While y_t steadily enters (3) with the lag order from (2) that yields the smallest FPE, m^* , x_t enters with a sequence of lags varying from 1 to n . The FPE of (3) is computed, with the specific lag order m^*, n^* being chosen which generates the smallest FPE, denoted $FPE_y(m^*, n^*)$, from:

$$FPE_y(m^*, n) = \frac{(T + m + n + 1)}{(T - m - n - 1)} \times \frac{SSE}{T} \quad (5)$$

By comparing the two minimal FPE, we can draw conclusions regarding causality. If $FPE_y(m^*, 0) > FPE_y(m^*, n^*)$, then $x_t \Rightarrow y_t$, thus Granger causality is established. If $FPE_y(m^*, 0) < FPE_y(m^*, n^*)$, then $x_t \not\Rightarrow y_t$ and no Granger causality is detected. Testing for causality from y_t to x_t requires us to repeat the previously described steps, now with x_t as the dependent variable.

(b) Model specification

We adjust Hsiao's original approach to fit in with our analysis. (1) We use our unit root and cointegration test results, that is, we apply a difference filter to log-level data to achieve stationarity and employ an ECM whenever cointegration evidence requires this. (2) In order to obviate the possibility of spurious causality we run the causality analyses in trivariate models; that is we test for causality between two series, conditional upon the presence of a third. Our earlier discussion of possible interactions between finance, growth, and trade openness provides the ground for such specifications. Short-run causality inferences are made by comparing the minimal FPE of the bivariate and trivariate model. If we include an ECM to account for cointegration, we take it as an indicator of long-run causality. If no cointegration is accounted for, then we run the analyses in simple trivariate VAR in log-differences and examine the respective F -test results that indicate significance of the regression coefficients. If the F -test statistics are not significant, then causality inferences have only limited explanatory power.

(c) Finance-growth causality

The theory suggests that finance may be either an important or a negligible factor of economic development. As for the former, we expect support for the supply-leading or bidirectional causality hypothesis. As for the latter, we expect support for demand-following or insignificant finance-growth causation.

Table 4 gives the results of the interaction between *DEPTH* and *GROWTH*, conditional on *TRADE*. The results generally show no sign of autocorrelation or multicollinearity and are statistically significant and stable, in particular with respect to the lag orders chosen in accordance with the causality testing procedure.

The analysis reveals only weak causal linkages between financial depth and economic growth for the investigated countries. In particular, we find evidence of finance-led growth only in the cases of Rwanda, Sierra Leone, and South Africa. For Nigeria and Senegal, our findings suggest a feedback relationship between finance and growth, that is, bidirectional finance-growth causality. For Cameroon, Ghana, and Madagascar, the results support the demand-following hypothesis, so financial depth is caused by economic development. With respect to the other eight countries in the sample, our analysis does not show any significant causal links between finance and growth.

Our findings thus offer support for skeptical theoretical and empirical considerations on finance-growth linkages. With respect to the previously discussed deficiencies of financial systems, our results fit in reasonably well. Because of generally low levels of financial depth and related institutional shortcomings, it appears reasonable to find that for the considered *SSA* countries financial sectors interact with real sectors only marginally. Consequently, a policy focus on financial sector development in order to stimulate economic growth does not seem to be justified.

(d) Finance-openness causality

Theoretical considerations suggest that finance may unilaterally lead openness or that openness may induce financial development. A nexus between finance and openness may additionally allow for bidirectional causality. Following more skeptical views, we may also find no evidence of significant causality between finance and openness.

Table 5 shows the results for the causal inferences of *DEPTH* and *TRADE*, controlling for *GROWTH*. Our results again show no sign of autocorrelation or multicollinearity and appear to be stable, particularly with respect to the chosen lag orders.

Our findings appear to confirm the existence of a nexus between finance and trade openness. Nevertheless, neither we are able to identify a predominant causation pattern nor do causal relationships appear to be stable in the long run for many investigated countries. Specifically, we find evidence of the hypothesis that finance causes openness for Gabon, Kenya, Nigeria, and Sierra Leone, where in the case of Sierra Leone results do not indicate stable long-run causality. Our findings suggest that openness has unilaterally influenced financial depth in the cases of Ghana, Madagascar, and Rwanda, where for Rwanda long-run causation inferences are not robust. For Burundi, Mauritius, Senegal, and South Africa, the causality analysis points at a feedback relationship between the two series, where some of the F -test statistics or ECM estimates hint at the possibility of spurious correlations. In the cases of Cameroon, Cote d'Ivoire, Ethiopia, The Gambia and Togo, we do

Table 4. Causality analysis for DEPTH and GROWTH

Country	FPE	FPE	ECM	F-Stats	D → G		FPE	FPE	ECM	F-Stats	G → D	
	(m,0,p)	(m,n,p)			(i) short-run	(ii) long-run	(m,0,p)	(m,n,p)			(i) short-run	(ii) long-run
Burundi	0.0057 (1,0,4)	0.0059 (1,1,4)	–	0.392	(i) No	(ii) –	0.1025 (1,0,1)	0.1072 (1,1,1)	–	2.150	(i) No	(ii) –
Cameroon	0.0025 (4,0,1)	0.0027 (4,1,1)	–	3.942***	(i) No	(ii) –	0.0529 (2,0,1)	0.0527 (2,1,1)	–	4.856***	(i) Yes	(ii) –
Cote d'Ivoire	0.0026 (4,0,3)	0.0036 (4,1,3)	–	1.432	(i) No	(ii) –	0.1704 (1,0,1)	0.1754 (1,1,1)	–	0.570	(i) No	(ii) –
Ethiopia	0.0066 (2,0,1)	0.0070 (2,1,1)	–	1.823	(i) No	(ii) –	0.1617 (1,0,1)	0.1633 (1,2,1)	–	1.381	(i) No	(ii) –
Gabon	0.0139 (1,0,1)	0.0143 (1,1,1)	–	0.419	(i) No	(ii) –	0.4872 (2,0,1)	0.4876 (2,1,1)	–	1.345	(i) No	(ii) –
Ghana	0.0052 (3,0,4)	0.0058 (3,1,4)	–0.628***	–	(i) No	(ii) No	0.2323 (2,0,1)	0.2056 (2,1,1)	0.031***	–	(i) Yes	(ii) Yes
Kenya	0.0010 (1,0,3)	0.0011 (1,1,3)	–	0.811	(i) No	(ii) –	0.1611 (1,0,4)	0.1670 (1,1,4)	–	2.242*	(i) No	(ii) –
Madagascar	0.0017 (1,0,3)	0.0018 (1,1,3)	–	0.982	(i) No	(ii) –	0.1293 (4,0,1)	0.1212 (4,1,1)	–	3.570***	(i) Yes	(ii) –
Mauritius	0.0012 (1,0,1)	0.0013 (1,1,1)	–	1.267	(i) No	(ii) –	0.0547 (4,0,1)	0.0580 (4,1,1)	–	2.593**	(i) No	(ii) –
Nigeria	0.0045 (2,0,2)	0.0042 (2,1,2)	–0.195*	–	(i) Yes	(ii) Yes	0.2325 (1,0,1)	0.1943 (1,1,1)	–0.027***	–	(i) Yes	(ii) Yes
Rwanda	0.0209 (1,0,4)	0.0136 (1,1,4)	–0.788***	–	(i) Yes	(ii) Yes	0.0617 (4,0,1)	0.0625 (4,1,1)	–0.007	–	(i) No	(ii) No
Senegal	0.0029 (1,0,1)	0.0024 (1,1,1)	–0.705***	–	(i) Yes	(ii) Yes	0.2121 (2,0,3)	0.0982 (2,1,3)	–0.013***	–	(i) Yes	(ii) Yes
Sierra Leone	0.0027 (1,0,1)	0.0013 (1,3,1)	–0.381***	–	(i) Yes	(ii) Yes	0.2110 (1,0,1)	0.2184 (1,1,1)	–0.014	–	(i) No	(ii) No
South Africa	0.0004 (2,0,1)	0.0003 (2,2,1)	–	2.449*	(i) Yes	(ii) –	0.0935 (1,0,3)	0.0986 (1,1,3)	–	1.473	(i) No	(ii) –
The Gambia	0.0017 (3,0,4)	0.0024 (3,2,4)	–	1.177	(i) No	(ii) –	0.2020 (1,0,1)	0.2113 (1,1,1)	–	0.190	(i) No	(ii) –
Togo	0.0034 (1,0,1)	0.0036 (1,1,1)	–	0.658	(i) No	(ii) –	0.1256 (1,0,2)	0.1327 (1,1,2)	–	–3.236**	(i) No	(ii) –

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the exception of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lags) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or F-test statistic at 10%, 5% and 1% levels, respectively, (a) indicates an insignificant F-statistic, while (b) indicates an ECM term that is insignificant or has a wrong sign.

not find evidence of any significant causal linkages between finance and trade openness.

Based on our findings we conclude that there are indeed interactions between finance and trade openness in SSA, as theories on the finance-openness nexus imply. Still, such linkages do not appear to be of particular importance and strength for the SSA countries in our sample, as indicated by the many cases where finance and openness are unrelated or where the relationship lacks long-run stability. Policies that aim at enhancing a country's financial depth are thus rather unlikely to significantly shape trade structures as a by-product. Along the lines of this argument, policies that are targeted at increasing the levels of openness cannot be expected to have substantial finance-promoting effects.

Further, the effect of finance-openness linkages on general economic development in the investigated SSA countries is rather marginal. On the one hand, the influence of trade openness on financial depth has not translated into economic growth, as our previous results have already shown. Only in the cases of Rwanda, Senegal, and South Africa does it seem that openness has interacted with financial depth, which in turn has contributed to economic growth; these results suffer from problems that are either associated with insignificant F-test statistics or undetectable long-run causality. In other

words, there is limited evidence of an indirect effect of openness on growth *via* the channel of financial development.

On the other hand, neither do we find strong evidence of the hypothesis that finance-induced advances in trade openness have translated into enhanced economic performance. This is apparent from the causality analysis results of GROWTH and TRADE, conditional upon DEPTH, which is presented in Table 6. Here, in most cases either growth Granger-causes trade openness or both series share a feedback relationship. This is consistent with the findings of Berthelemy and Varoukakis (1996) who also detect no sizeable effect of openness on growth in the presence of weak financial systems. When we combine our findings from Tables 5 and 6, we see that only in the case of Nigeria financial depth has actually had a significant effect on openness, while openness has simultaneously influenced economic growth. In all other cases, no indirect effect of financial deepening on economic growth through the channel of trade openness can be demonstrated. We believe that the generally limited gains of the investigated SSA countries from trade openness (in the sense of a leading impact of openness on growth) can be explained by two instances. First, trade (exports) in SSA is strongly based on primary goods. Countries specializing in primary good exports are less likely to realize learning spill overs, industry linkages, and dynamic

Table 5. Causality analysis for *DEPTH* and *TRADE*

Country	FPE)	FPE	ECM	<i>F</i> -Stats	D → T		FPE	FPE	ECM	<i>F</i> -Stats	T → D	
	(m,0,p)	(m,n,p)			(i) short-run	(ii) long-run					(i) short-run	(ii) long-run
Burundi	0.0247 (3,0,1)	0.0246 (3,2,1)	–	1.411	(i) Yes ^a	(ii) –	0.1082 (1,0,1)	0.1072 (1,1,1)	–	2,15	(i) Yes ^a	(ii) –
Cameroon	0.0032 (2,0,2)	0.0034 (2,1,2)	–	2.992**	(i) No	(ii) –	0.0501 (2,0,1)	0.0527 (2,1,1)	–	4.856***	(i) No	(ii) –
Cote d'Ivoire	0.0055 (1,0,4)	0.0065 (1,1,4)	–	2.291*	(i) No	(ii) –	0.1691 (1,0,1)	0.1704 (1,1,1)	–	0.570	(i) No	(ii) –
Ethiopia	0.0268 (3,0,1)	0.0272 (3,1,1)	–	2.955**	(i) No	(ii) –	0.1577 (1,0,2)	0.1633 (1,1,2)	–	1.381	(i) No	(ii) –
Gabon	0.0092 (1,0,1)	0.0089 (1,1,1)	–	3.014**	(i) Yes	(ii) –	0.4635 (2,0,1)	0.4876 (2,1,1)	–	1.345	(i) No	(ii) –
Ghana	0.0209 (1,0,1)	0.0213 (1,1,1)	–0.147**	–	(i) No	(ii) No	0.2109 (2,0,1)	0.2056 (2,1,1)	–0.031**	–	(i) Yes	(ii) Yes
Kenya	0.0101 (1,0,3)	0.0081 (1,4,3)	–	3.111**	(i) Yes	(ii) –	0.1472 (1,0,2)	0.1759 (1,4,2)	–	1.921	(i) No	(ii) –
Madagascar	0.0211 (4,0,1)	0.0214 (4,1,1)	–	1.776	(i) No	(ii) –	0.1275 (4,0,1)	0.1212 (4,1,1)	–	3.570***	(i) Yes	(ii) –
Mauritius	0.0037 (3,0,1)	0.0033 (3,2,1)	–	3.926***	(i) Yes	(ii) –	0.0623 (4,0,1)	0.0580 (4,1,1)	–	2.593**	(i) Yes	(ii) –
Nigeria	0.1105 (2,0,1)	0.0898 (2,1,1)	–0.043*	–	(i) Yes	(ii) Yes	0.1888 (1,0,1)	0.1943 (1,1,1)	–0.027***	–	(i) No	(ii) No
Rwanda	0.0546 (2,0,1)	0.0626 (2,4,1)	0.156***	–	(i) No	(ii) No	0.0668 (4,0,1)	0.0625 (4,1,1)	–0.007	–	(i) Yes	(ii) No ^b
Senegal	0.0141 (1,0,1)	0.0133 (1,1,1)	0.118*	–	(i) Yes	(ii) No ^b	0.1622 (2,0,3)	0.0796 (2,4,3)	0.108***	–	(i) Yes	(ii) No ^b
Sierra Leone	0.0405 (1,0,1)	0.0367 (1,1,1)	0.027	–	(i) Yes	(ii) No ^b	0.2094 (1,0,1)	0.2184 (1,1,1)	–0.014	–	(i) No	(ii) No
South Africa	0.0046 (1,0,2)	0.0045 (1,1,2)	–	1.666	(i) Yes ^a	(ii) –	0.0991 (1,0,1)	0.0986 (1,3,1)	–	1.473	(i) Yes ^a	(ii) –
The Gambia	0.0625 (3,0,1)	0.0802 (3,1,1)	–	0.500	(i) No	(ii) –	0.2028 (1,0,1)	0.2113 (1,1,1)	–	0.190	(i) No	(ii) –
Togo	0.0124 (2,0,1)	0.0129 (2,1,1)	–	2.493*	(i) No	(ii) –	0.1119 (1,0,1)	0.1327 (1,2,1)	–	3.236**	(i) No	(ii) –

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the exception of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lags) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or *F*-test statistic at 10%, 5% and 1% levels, respectively, (a) indicates an insignificant *F*-statistic, while (b) indicates an ECM term that is insignificant or has a wrong sign.

externalities promoting productivity growth. Hence, specializing in primary good exports is less likely to induce sustainable economic growth (see e.g., Fosu 1996). Second, as mentioned institutional environments in *SSA* are rather poor. As shown by Borrmann, Busse, and Neuhaus (2006), certain institutional settings (e.g., with respect to taxation or regulation) allow countries to benefit from trade. When institutions are underdeveloped (as in *SSA*), countries are less likely to benefit from trade. That is, our evidence of causality between *TRADE* and *GROWTH* can be explained by prevailing trade and specialization patterns in *SSA* and by poor institutional settings which do not favor gains from trade.

(e) Robustness

Previously, we relied on a composite indicator of financial depth. While the use of this index yields some advantages which we have discussed, it may also have some disadvantages. Such shortcomings may, for example, be associated with a limited interpretability of the index. Accordingly, we once again perform our empirical analysis, this time using *liquid liabilities to GDP (LL)* as our indicator of financial depth. This measure is a more traditional finance indicator, having been employed, for example, by King and

Levine (1993). Using *LL* instead of *DEPTH* should help to assess the validity of our previous empirical findings. We follow the same econometric procedure as introduced above.⁶

In general, the robustness findings confirm our previous results. (1) Unit root and cointegration tests show almost identical patterns when using *LL* instead of *DEPTH*.⁷ (2) Causal links between finance (*LL*) and growth are similarly weak. In eight of 16 cases, finance and growth do not share a significant causal connection; evidence of the supply-leading and the bidirectional causality hypothesis is confirmed twice, while evidence of a demand-following relationship is found four times. (3) The causal relationship between finance and trade openness becomes somewhat stronger. In only 4 of 16 cases finance and trade are unconnected; in two cases finance leads openness, whereas openness leads finance in five countries. For five countries in our sample there is bidirectional causality between the two series. (4) Controlling only for *LL* instead of *DEPTH*, the growth effect of trade openness becomes generally more pronounced, whereas the effect of growth on trade openness remains stable. Because of this finding, the indirect effect of finance on growth by impacting trade openness is somewhat strengthened when employing only *LL* as our finance indicator.⁸

Table 6. Causality analysis for GROWTH and TRADE

Country	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	G → T (i) short-run (ii) long-run	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	T → G (i) short-run (ii) long-run
Burundi	0.0238 (3,0,2)	0.0246 (3,1,2)		1.411	(i) No (ii) –	0.0056 (1,0,4)	0.0059 (1,1,4)	...	0.365	(i) No (ii) –
Cameroon	0.0038 (2,0,1)	0.0034 (2,2,1)		2.992**	(i) Yes (ii) –	0.0028 (4,0,1)	0.0027 (4,1,1)	...	3.942**	(i) Yes (ii) –
Cote d'Ivoire	0.0091 (1,0,1)	0.0065 (1,4,1)		2.291*	(i) Yes (ii) –	0.0034 (4,0,1)	0.0032 (4,1,1)	...	1.975	(i) Yes ^a (ii) –
Ethiopia	0.0342 (3,0,1)	0.0272 (3,1,1)		2.955**	(i) Yes (ii) –	0.0067 (2,0,1)	0.0070 (2,1,1)	...	1.823	(i) No (ii) –
Gabon	0.0089 (3,0,1)	0.0088 (3,1,1)		3.014**	(i) Yes (ii) –	0.0137 (1,0,4)	0.0145 (1,1,4)	...	1.185	(i) No (ii) –
Ghana	0.0230 (1,0,2)	0.0246 (1,1,2)	–0.028**		(i) No (ii) No	0.0052 (3,0,4)	0.0061 (3,2,4)	–0.748***	...	(i) No (ii) No
Kenya	0.0100 (1,0,4)	0.0081 (1,3,4)		3.111*	(i) Yes (ii) –	0.0009 (1,0,3)	0.0011 (1,1,3)	...	0.827	(i) No (ii) –
Madagascar	0.0202 (4,0,1)	0.0214 (4,1,1)		1.776	(i) No (ii) –	0.0017 (1,0,1)	0.0018 (1,3,1)	...	0.982	(i) No (ii) –
Mauritius	0.0040 (3,0,2)	0.0033 (3,1,2)		3.926***	(i) Yes (ii) –	0.0012 (1,0,2)	0.0013 (1,1,2)	...	1.361	(i) No (ii) –
Nigeria	0.1090 (2,0,1)	0.1060 (2,1,1)	–0.027**		(i) Yes (ii) Yes	0.0045 (2,0,1)	0.0041 (2,1,1)	–0.219**	...	(i) Yes (ii) Yes
Rwanda	0.0754 (2,0,1)	0.0751 (2,2,1)	0.091		(i) Yes (ii) No ^b	0.0217 (1,0,1)	0.0136 (1,4,1)	–0.788***	...	(i) Yes (ii) Yes
Senegal	0.0149 (1,0,1)	0.0133 (1,1,1)	0.118*		(i) Yes (ii) No ^b	0.0019 (1,0,1)	0.0024 (1,2,1)	–0.819***	...	(i) No (ii) No
Sierra Leone	0.0381 (1,0,2)	0.0378 (1,1,2)	–0.089		(i) Yes (ii) No ^b	0.0015 (1,0,1)	0.0016 (1,1,1)	–0.182***	...	(i) No (ii) No
South Africa	0.0043 (1,0,2)	0.0045 (1,1,2)		1.761	(i) No (ii) –	0.0003 (2,0,2)	0.0004 (2,1,2)	...	2.449*	(i) No (ii) –
The Gambia	0.0791 (3,0,1)	0.0802 (3,1,1)		0.500	(i) No (ii) –	0.0021 (3,0,1)	0.0022 (3,1,1)	...	1.256	(i) No (ii) –
Togo	0.0125 (2,0,1)	0.0109 (2,3,1)		3.457**	(i) Yes (ii) –	0.0035 (1,0,1)	0.0036 (1,1,1)	...	0.658	(i) No (ii) –

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the exception of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lags) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or F-test statistic at 10%, 5% and 1% levels, respectively, (a) indicates an insignificant F-statistic, while (b) indicates an ECM term that is insignificant or has a wrong sign.

(f) Discussion and policy implications

Our findings do not indicate (1) a strong link between finance and growth for most of the sample. They point at (2) somewhat stronger links between finance and trade openness, and (3) between openness and growth. (4) There is no causality pattern between finance and growth that is identical for all countries in the sample.

Our findings support the empirical studies that do not find strong links between finance and growth (e.g., *Shan et al.*, 2001). Still, other studies do find strong links. For instance, *Christopoulos and Tsionas* (2004) find strong support for the hypothesis of finance-led growth in their panel of ten developing economies. We attribute the different findings of studies on finance-growth causality to different country samples rather than to differences in methodology.⁹ Generally, our findings support the view that “one size does not fit all” when analyzing finance-growth interactions (*Rioja & Valev*, 2004). That is, the actual effect of finance on growth (and *vice versa*) seems to depend on the level of financial development. When the level of financial development is low (as in *SSA*), the effect of finance on growth is uncertain (*Rioja & Valev*, 2004). Our empirical results also add to the findings of *Col-*

lier and Gunning (1999) who find that deficiencies in *SSA* financial systems lead to a negligible impact of finance on development, and to those of *Reinhart* (2003) who detect no positive effects of financial liberalization on economic growth in *SSA*.

We can only conjecture why financial deepening does not contribute to economic development for the *SSA* countries investigated. Potentially, times of civil conflict or political instability retard financial deepening. Moreover, the institutional settings of the analyzed countries differ, with countries with weaker institutions (e.g., legal systems or financial regulation) also exhibiting less-developed financial systems (*Ncube*, 2007). History may also play a role in this respect, as present institutional settings are strongly rooted in a country's (colonial) past. Other factors such as geographical features, resource abundance and initial levels of economic development may also determine the degree of financial deepening and in turn impact on the strength and causality direction of the finance-trade and finance-growth nexus. Variations in, *inter alia*, political stability or institutional surroundings may thus explain why we do not find just one convenient link between finance, openness, and growth for the *SSA* countries analyzed.¹⁰

Our analysis reveals that only few of the *SSA* countries in our sample have actually benefited directly or indirectly from financial factors, while the direct and indirect effect of trade openness on growth is somewhat more pronounced; potentially, unfavorable trade structures and poor institutional settings impede stronger gains from trade. Development strategies that *unilaterally* emphasize either financial or trade sector development do not appear to be feasible for the countries in our sample. While our findings indicate that finance and finance-related policies have not mattered in the past, we do not infer from our evidence that finance is potentially irrelevant to development in the future; evidence from other parts of the world suggests that finance may indeed promote growth. Obstacles to growth in *SSA* (e.g., poor institutions and political instability) are also obstacles to the development of financial markets. That is, economic policies that aim at axing growth obstacles may also be helpful in promoting financial deepening, thereby helping to overcome financial system deficiencies and benefiting finance-growth dynamics. Possible promising development strategies are greater political and macroeconomic stability or improved institutional quality, all of which may also influence financial development favorably (e.g., Montiel, 2003; Demetriades & Law, 2006). A general approach taking into account various fundamental determinants of development seems to be more appropriate for our sample of *SSA* countries. Thanks to such policies, over time the development of financial systems may correspond more adequately to real sector activities, in consequence facilitating economic development. At the same time, such policies may help countries to gain more from trade.

5. SUMMARY

Drawing on conflicting considerations about the links between financial deepening, economic development, and trade

openness, we tested for causality for 16 *SSA* countries. *Inter alia*, we used a principal component analysis to obtain a broad indicator of financial deepening. We employed unit root and cointegration tests to analyze the properties of the investigated time series and to identify possible long-run relationships between them. We used Hsiao's version of testing for Granger causality within *VAR/VECM* frameworks due to its methodological advantages over standard causality tests.

Our empirical results show that (1) finance, growth, and openness do not share significant long-run relationships for most of the sample. (2) We detect only limited support for causal interactions of financial depth and economic development. In particular, there is only sparse support for the hypothesis of finance-led growth. For most countries we detect either a demand-following or an insignificant relationship between finance and growth. We thus provide support for more skeptical views on the finance-growth nexus that does not identify universally valid finance-growth links. (3) While there is ample evidence of a nexus between finance and openness, we are not able to identify any predominant relationship for the investigated *SSA* countries. There is also only limited evidence to suggest that either financial deepening has promoted economic development indirectly *via* influencing trade openness or that openness has enhanced growth as a by-product of its impact on financial development. In the light of our results, we (4) question policies that prioritize financial and/or trade sector development. Financial deepening and (to a weaker extent) trade openness do not appear to have been crucial preconditions of economic development in *SSA*. Instead, we advocate a more balanced policy approach that also takes into account other fundamental development factors, for example political or macroeconomic stability, or institutional quality. A general approach toward strengthening of these factors may also help to reduce deficiencies in financial systems, so countries in *SSA* may benefit from financial deepening in the future. Such an approach should also help countries in *SSA* to gain more from trade openness.

NOTES

1. For a far more extensive discussion of the potential linkages between finance and growth, we refer to the surveys of Pagano (1993) and Levine (2005).

2. An effect from economic growth to trade openness is also possible. For instance, economic development may trigger a country's level of trade openness, for example, as it produces shifts in national production and demand patterns.

3. In general, the *Financial Development and Structure Database* provides complete information across series and countries. In the few cases where variables are missing, we impute these by average. As the database builds on IMF and World Bank data we are confident that this is the most reliable finance data for the *SSA* countries analyzed. Still, we acknowledge the possibility that "informal" finance (for which no data is available) may also matter to finance-growth links. See Atindehou *et al.* (2005) for a similar discussion. We are also confident that the sample periods used here are long enough to provide information on long-run causality, given that other studies (e.g., Ghirmay, 2004; Luintel & Khan, 1999) use similar sample periods to test for cointegration. Nevertheless, we acknowledge that longer sample periods would be more appropriate to test for long-run relationships, as discussed by Hakkio and Rush (1991).

4. There are a number of potentially more sophisticated trade openness measures (e.g., Harrison, 1996). Still, these measures raise the question of

availability. We acknowledge that our measure is a rather rough openness indicator which, however, constitutes a convenient trade off between accessibility and accuracy.

5. Cointegration analyses have also been conducted in all bivariate cases but are not reported due to space constraints.

6. We do not explicitly report our robustness findings due to space constraints. The results are available on request.

7. Only in the case of Kenya do the cointegration results indicate a long-run equilibrium between finance, openness and growth when using *LL* as the single finance proxy.

8. In general, we wish to stress that there are no substantial changes to our earlier assessment on what countries have or have not benefited from finance-openness-growth links. Rather, we detect variations in the stability of short-run and long-run causality. The only country where we note considerable changes is Nigeria, where the effect of finance on growth and on trade diminishes when using *LL*, while the effect of trade openness on growth and finance becomes more pronounced. Our robustness results are a somewhat stronger indication of the role of trade for development in Nigeria.

9. Note that Christopoulos and Tsionas (2004) analyze finance-growth causality (using a panel causality approach) for ten developing economies, only one of which is in SSA. Note also that our robustness check indicates that our findings are not random, so different methodologies are less likely to account for varying results than different country samples.

10. Another factor that may account for the weak links between finance and growth is “unofficial” finance for which there is no data. If informal finance contributes to development, then our estimations may underestimate the importance of financial markets on growth for SSA. Atindehou *et al.* (2005) argue similarly.

REFERENCES

- Adjasi, C. K. D., & Biekpe, N. B. (2006). Stock market development and economic growth: The case of selected African countries. *African Development Review*, 18(1), 141–161.
- Akaïke, H. (1969). Fitting autoregressions for prediction. *Annals of the Institute of Statistical Mathematics*, 21, 243–247.
- Ang, J. B., & McKibbin, W. J. (2007). Financial liberalization, financial sector development and growth: Evidence from Malaysia. *Journal of Development Economics*, 84, 215–233.
- Anoruo, E., & Ahmad, Y. (2001). Causal relationship between domestic savings and economic growth: Evidence from seven African countries. *African Development Review*, 13(2), 238–249.
- Atindehou, R. B., Gueyie, J. P., & Amenounve, E. K. (2005). Financial intermediation and economic growth: Evidence from Western Africa. *Applied Financial Economics*, 15(11), 777–790.
- Baltagi, B. H., Demetriades, P. O., & Law, S. H. (2009). Financial development and openness: Evidence from panel data. *Journal of Development Economics*, 89(2), 285–296.
- Beck, T. (2003). Financial dependence and international trade. *Review of International Economics*, 11(2), 296–316.
- Beck, T., Demirgüç-Kunt, A., & Levine, R. (2001). A new database on financial development and structure. *World Bank Economic Review*, 14, 597–605.
- Berthelemy, J.-C., & Varoudakis, A. (1996). Economic growth, convergence clubs, and the role of financial development. *Oxford Economic Papers*, 48, 300–328.
- Borrmann, A., Busse, M., & Neuhaus, S. (2006). Institutional Quality and the gains from trade. *Kyklos*, 59(3), 345–368.
- Braun, P. A., & Mittnik, S. (1993). Misspecifications in vector autoregressions and their effects on impulse responses and variance decompositions. *Journal of Econometrics*, 59, 319–341.
- Chandavarkar, A. (1992). Of finance and development: Neglected and unsettled questions. *World Development*, 20(1), 133–142.
- Chang, T., & Caudill, S. B. (2005). Financial development and economic growth: The case of Taiwan. *Applied Economics*, 37, 1329–1335.
- Cheung, Y.-W., & Lai, K. S. (1993). Finite-sample sizes of Johansen’s likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and Statistics*, 55(3), 313–328.
- Choe, C., & Moosa, I. A. (1999). Financial system and economic growth: The Korean experience. *World Development*, 27(6), 1069–1082.
- Choi, I., & Chung, B. S. (1995). Sampling frequency and the power of tests for a unit root: A simulation study. *Economic Letters*, 49, 131–136.
- Christopoulos, D. K., & Tsionas, E. G. (2004). Financial development and economic growth: Evidence from panel unit root and cointegration tests. *Journal of Development Economics*, 73, 55–74.
- Collier, P., & Gunning, J. W. (1999). Explaining African economic performance. *Journal of Economic Literature*, 37, 64–111.
- Demetriades, P. O., & Hussein, K. A. (1996). Does financial development cause economic growth? Time-series evidence from 16 countries. *Journal of Development Economics*, 51, 387–411.
- Demetriades, P. O., & Law, S. H. (2006). Finance, institutions and economic development. *International Journal of Finance and Economics*, 11, 245–260.
- Edwards, S. (1998). Openness, productivity and growth: What do we really know?. *The Economic Journal*, 108, 383–398.
- Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251–276.
- Fosu, A. K. (1996). Primary exports and economic growth in developing countries. *World Economy*, 19, 465–475.
- Ghirmay, T. (2004). Financial development and economic growth in Sub-Saharan African countries: Evidence from time series analysis. *African Development Review*, 16(3), 415–432.
- Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37(3), 424–438.
- Hakkio, C. S., & Rush, M. (1991). Cointegration: How short is the long run?. *Journal of International Money and Finance*, 10, 571–581.
- Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics*, 48, 419–447.
- Heston, A., Summers, R., & Aten, B. (2006). *Penn World Table Version 6.2, income and prices at the University of Pennsylvania*. Center for International Comparisons of Production.
- Hsiao, C. (1979). Autoregressive modelling of Canadian money and income data. *Journal of the American Statistical Association*, 74(367), 553–560.
- Hsiao, C. (1982). Autoregressive modelling and causal ordering of economic variables. *Journal of Economic Dynamics and Control*, 4, 243–259.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12, 231–254.
- King, R. G., & Levine, R. (1993). Finance, entrepreneurship, and growth. *Journal of Monetary Economics*, 32, 513–542.
- Levine, R. (2005). Finance and growth: Theory and evidence. In P. Aghion, & S. N. Durlauf (Eds.), *Handbook of economic growth* (1st ed., pp. 865–934). Amsterdam, The Netherlands: Elsevier.
- Luintel, K. B., & Khan, M. (1999). A quantitative reassessment of the finance-growth nexus: Evidence from a multivariate VAR. *Journal of Development Economics*, 60, 381–405.
- MacKinnon, J. G. (1996). Numerical distribution functions for unit root and cointegration tests. *Journal of Applied Econometrics*, 11, 601–618.
- MacKinnon, J. G., Haug, A. A., & Michelis, L. (1999). Numerical distribution functions of likelihood ratio tests for cointegration. *Journal of Applied Econometrics*, 14, 563–577.
- Montiel, P. J. (2003). Development of financial markets and macroeconomic policy. *Journal of African Economies*, 12(AERC Suppl. 2), 12–52.
- Ncube, M. (2007). Financial services and economic development in Africa. *Journal of African Economies*, 16(AERC Suppl. 1), 13–57.
- Ndikumana, L. (2000). Financial determinants of domestic investment in Sub-Saharan Africa: Evidence from panel data. *World Development*, 28(2), 381–400.
- Pagano, M. (1993). Financial markets and growth. An overview. *European Economic Review*, 37, 613–622.
- Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335–346.
- Rajan, R., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, 69, 5–50.
- Reinhart, C. M., & Tokatlidis, I. (2003). Financial liberalisation: The African experience. *Journal of African Economies*, 12(AERC Suppl. 2), 53–88.
- Rioja, F., & Valev, N. (2004). Does one size fit all? A reexamination of the finance and growth relationship. *Journal of Development Economics*, 74(2), 429–447.
- Robinson, J. (1952). *The rate of interest, and other essays*. London: Macmillan.
- Rousseau, P. L., & Wachtel, P. (1998). Financial intermediation and economic performance. Historical evidence from five industrialized countries. *Journal of Money, Credit and Banking*, 30(4), 657–678.
- Sachs, J. D., & Warner, A. M. (1997). Sources of slow growth in African Economies. *Journal of African Economies*, 6(3), 335–376.
- Shan, Z. J., Morris, A. G., & Sun, F. (2001). Financial development and economic growth: An egg-and-chicken problem?. *Review of International Economics*, 9(3), 443–454.
- Svaleryd, H., & Vlachos, J. (2002). Markets for risk and openness to trade: How are they related?. *Journal of International Economics*, 57, 369–395.

Svaleryd, H., & Vlachos, J. (2005). Financial markets, the pattern of industrial specialization and comparative advantage: Evidence from OECD countries. *European Economic Review*, 49, 113–144.

Wickens, M. R. (1996). Interpreting cointegrating vectors and common stochastic trends. *Journal of Econometrics*, 74, 255–271.

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